Total Force Structure Analysis

Innovative Management Concepts

Sterling, VA

Robert J. Might

Briefing Outline

- Purpose and Advantages
- Examples
- Basic Concept
- Information Systems
- Future Development/Uses

Purpose

Describe an analytical method for studying force structure options and a mathematical program (model) that is an essential element of the method

What it is and What it isn't

This method helps identify what is valuable to the combatant commander based on system capability and cost

It Does Not

Help identify how to achieve a capability

That is, what capability do we want at a set cost - not how do I get the capability for the cost

Major Advantages Over Other Methods

- A method that simultaneously assesses systems across many mission areas, includes support systems and **information systems** (e.g. C4ISR)
- A method that is **directly linked to the Concepts of Operations** in each theater and will identify the force structure based on variations in the Concepts of Operation
- A method that is **task based** and can be directly linked to the UJTL and Service Task Lists

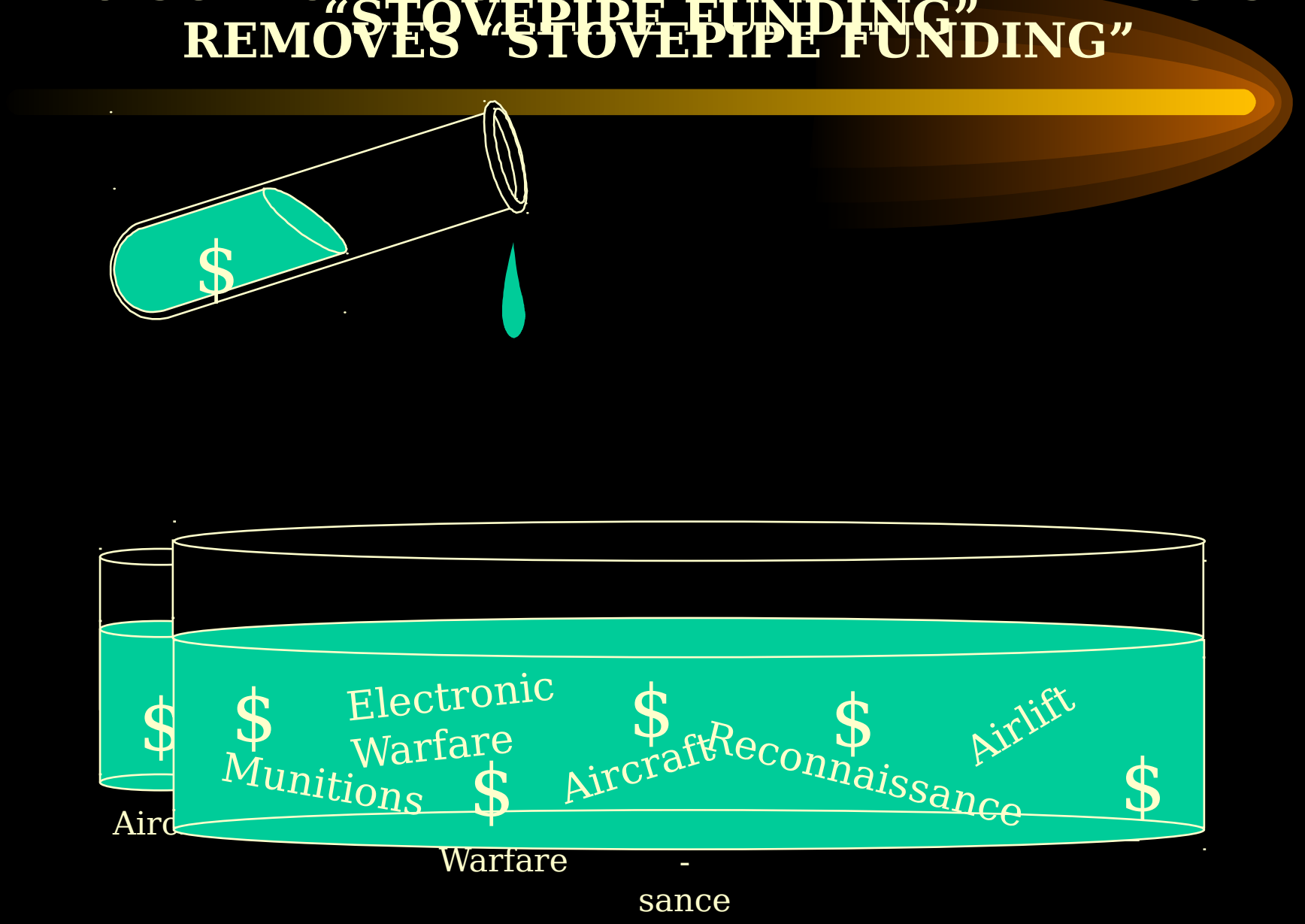
CURRENT ANALYTICAL METHODS

THE PROPOSED ANALYTICAL METHODS TO SUPPORT FORCE STRUCTURE ANALYSIS

TO SUPPORT FORCE STRUCTURE ANALYSIS

REMOVES "STOVEPIPE FUNDING"

"STOVEPIPE FUNDING"



The Basic Concept

TASKS & PRIORITIES

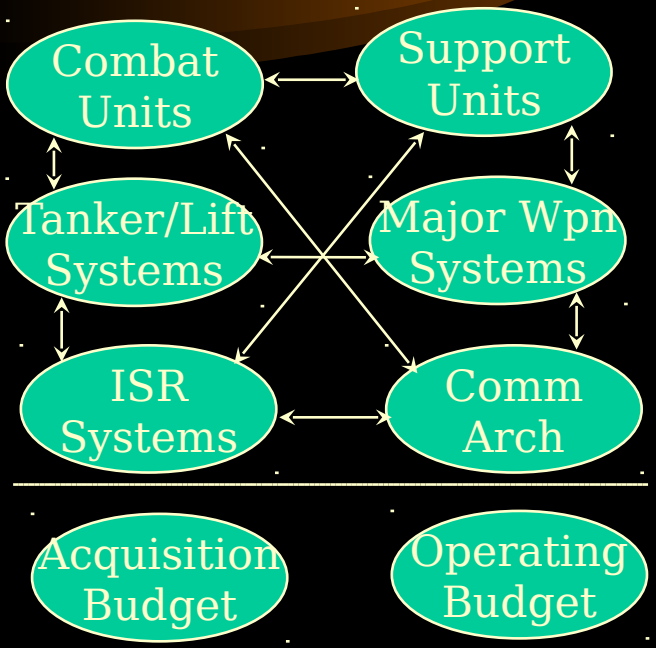
Destroy
Disrupt
Deny
Delay
Deploy
etc.

System/ Engagement Level Analyses

System/Unit Effectiveness by Task

Resource Allocation (Math Program)

RESOURCES



Example: Small/Notional Database

Tasks & Priorities

Resources

9 Destroy Tasks
9 Surveillance Tasks
4 Peacekeeping Tasks

Effectiveness & Resources Consumed per Task attempt

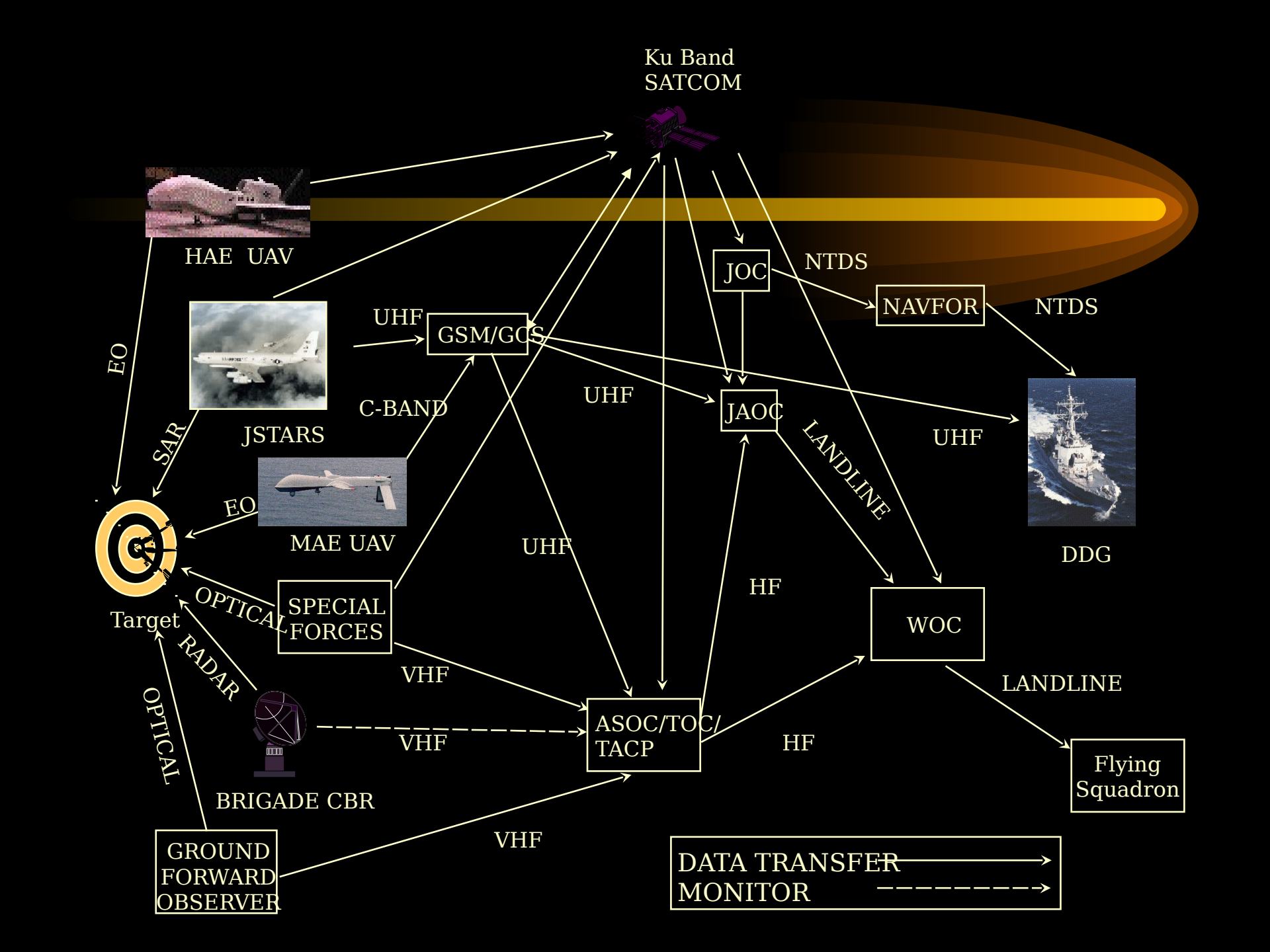
2 Aircraft
3 Munitions
2 Cruise Missiles
3 Battalions

Miscellaneous Data

existing systems
cost per system
aircraft sortie rate and loads
comm node and link capacities

8 Comm Nodes
25 Comm Links

2 Lift Systems


Ku Band
SATCOM
HAE UAV
JSTARS
MAE UAV
Target
DDG
JOC
NTDS
NAVFOR
NTDS
GSM/GCS
UHF
JAOC
UHF
UHF
LANDLINE
C-BAND
EO
SAR
EO
OPTICAL
RADAR
OPTICAL
SPECIAL
FORCES
UHF
HF
WOC
VHF
LANDLINE
ASOC/TOC/
TACP
VHF
HF
Flying
Squadron
BRIGADE CBR
GROUND
FORWARD
OBSERVER
VHF
DATA TRANSFER
MONITOR

Base Case

Existing Systems

72	F-15E
72	F-16
400	TLAM-C
400	TLAM-D

Systems Bought

39	F-15E
5	JSTARS
9	PREDATORS
49	GLOBAL HWK
15	LIFT SYSTEMS

Value of Tasks Completed

1,577,690

#1&2

Global Hawk P(discrim) > 30%

Budget > 50%

Systems Bought

160	38	39	F-15E
5	4	5	JSTARS
242	9	9	PREDATORS
89	56	49	GLOBAL HWK
18	16	15	LIFT SYSTEMS

Value of Tasks Completed

1,577,690

1,694,476

1,694,608

Base Case Excursion #1 Excursion #2

Base Case + Excursions #3&4

Global Hawk/SATCOM Link < 80%

Budget >50%

Systems Bought

106	22	39	F-15E
32	22	5	JSTARS
243	7	9	PREDATORS
29	15	49	GLOBAL HWK
13	11	15	LIFT SYSTEMS

Value of Tasks Completed

1,577,690

1,422,361

1,550,576

Base Case Excursion #3 Excursion #4

Base Case + Excursions #5&6

All KuBand Links < 50%

Budget >100%

Systems Bought

Base Case	Excursion #5	Excursion #6	
39	20	166	F-15E
5	14	33	JSTARS
9	5	355	PREDATORS
49	42	79	GLOBAL HWK
15	13	19	LIFT SYSTEMS

Value of Tasks Completed

Base Case	1,577,690
Excursion #5	1,301,189
Excursion #6	1,477,897

The Basic Concept

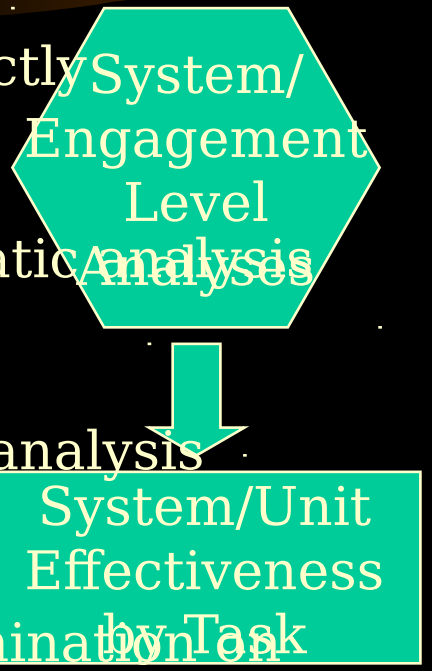
Additional Advantages

System developers must tie their analysis directly to the UJTL and Service Task Lists

System developers will therefore have systematic analysis requirements

System developers will have a more tractable analysis effort

System developers can make their own determination on the level of detail of their analysis - there is no arbitrary aggregation of system processes or performance parameters

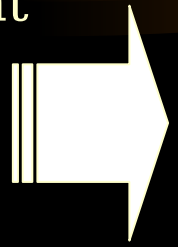


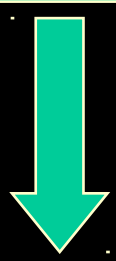
The Basic Concept

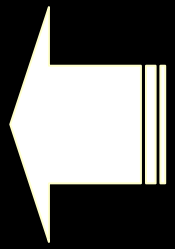
MOE's versus MOP's

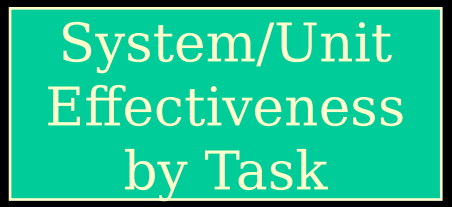
MOP's

Detection Range
Speed
Take-off Weight
Radar Cross Section
CEP
Satellite Orbit
Range









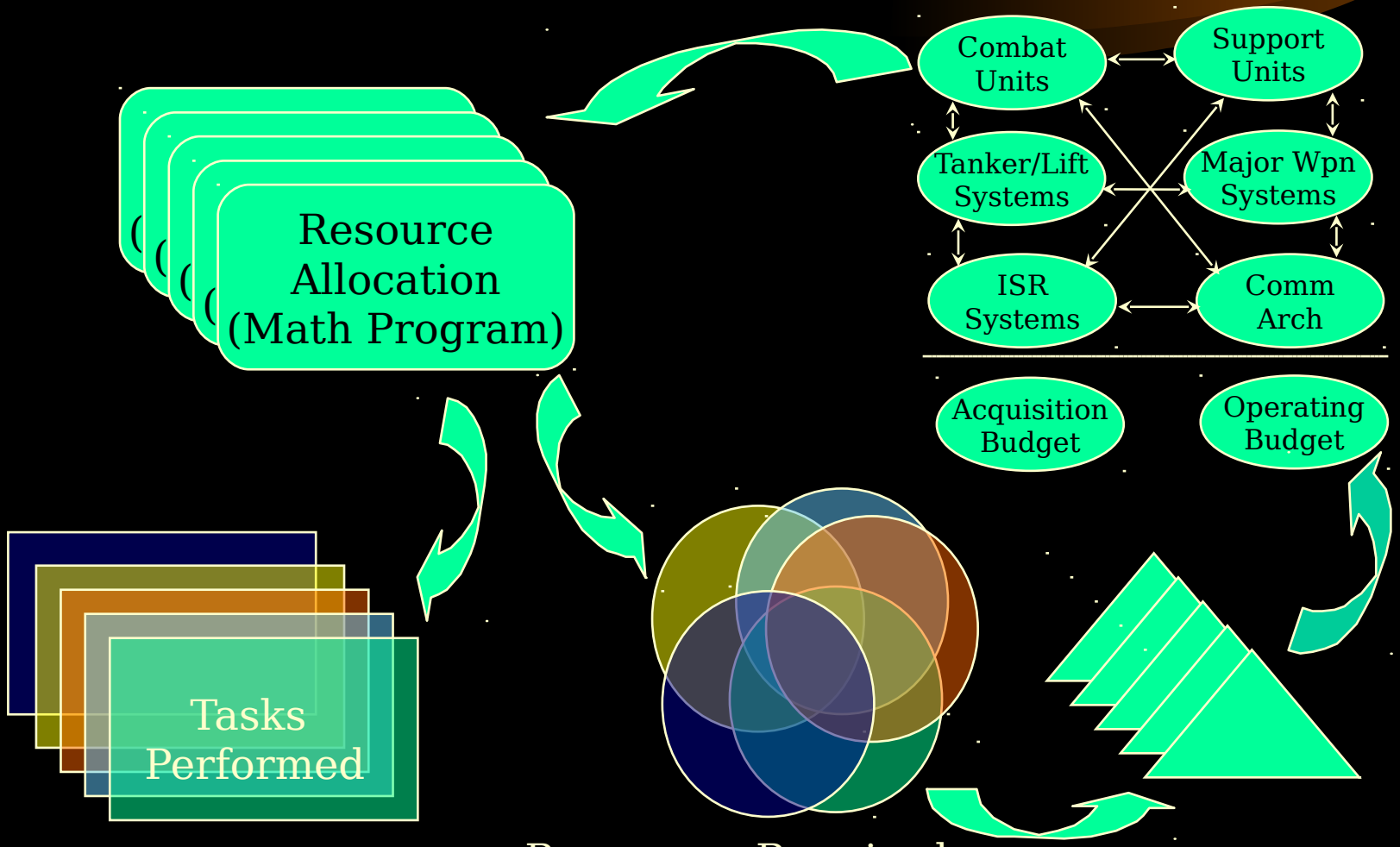
MOE's

PERCENT TASK COMPLETED BY A SINGLE SYSTEM					
	SYS #1	SYS #2	SYS #3		SYS #N
TASK #1	10%	N/A	35%		80%
TASK #2	45%	70%	100%		35%
TASK #3	60%	15%	30%		N/A
TASK #4	N/A	N/A	40%		N/A
TASK #5	20%	N/A	40%		65%
TASK #M	40%	100%	50%		20%

PERCENT RESOURCE CONSUMED BY TASK					
	SYS #1	SYS #2	SYS #3		SYS #N
TASK #1	2%	N/A	4%		7%
TASK #2	4%	3%	1%		3%
TASK #3	100%	100%	100%		N/A
TASK #4	N/A	N/A	40%		N/A
TASK #5	1%	N/A	40%		6%
TASK #M	3%	12%	4%		2%

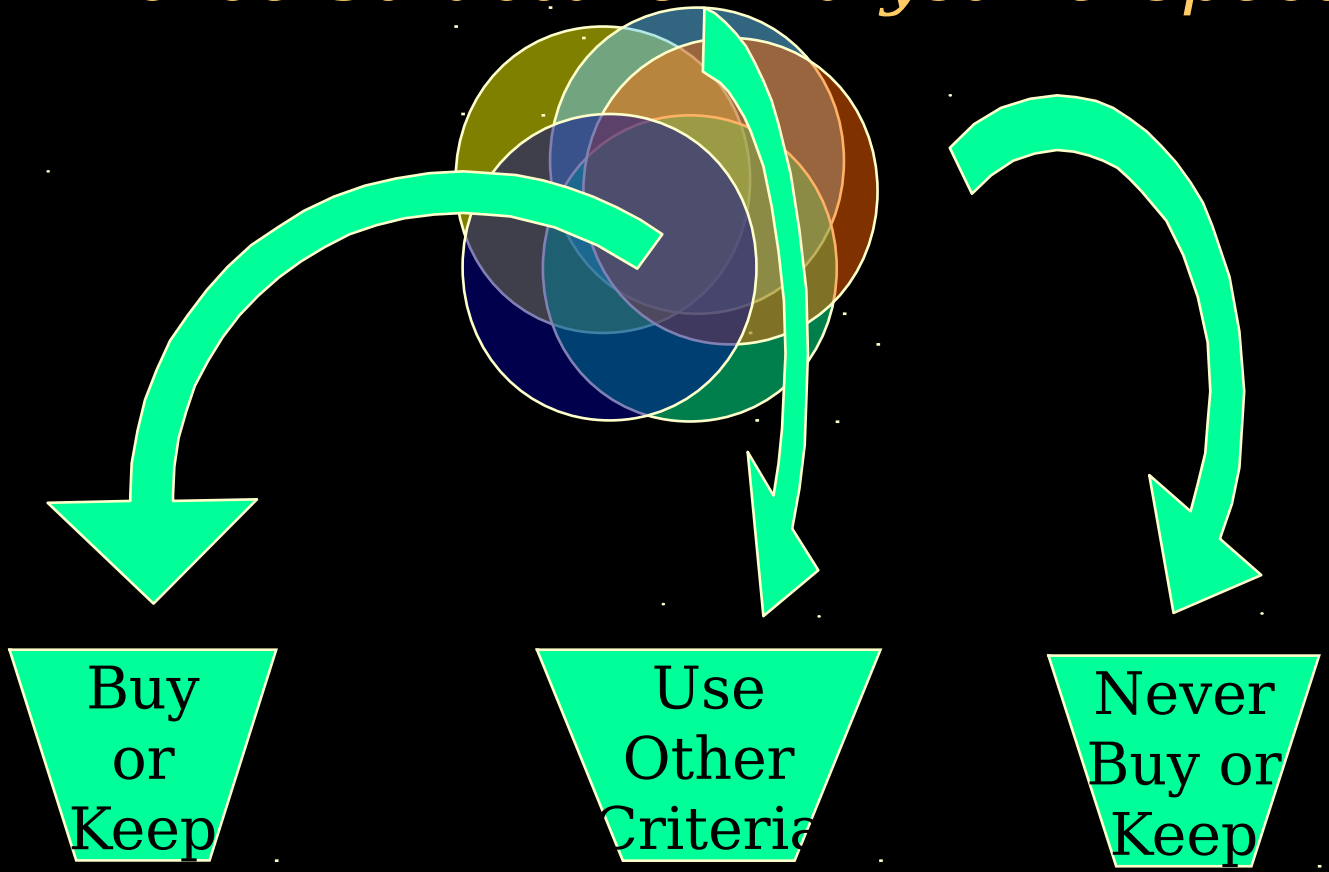
The Basic Concept

Force Structure Analyst Perspective



The Basic Concept

Force Structure Analyst Perspective



Typical Parametric Trade-offs
Systems Effectiveness Parameters

Weapon Systems and Units

Effectiveness performing each task
Attrition rate performing each task
Daily Utilization Rate/Availability
Munitions Load
Refueling needs
System Acquisition and Operating Costs

ISR Systems

Number of entities detected per system day (by entity type)

Number of entities classified per system day (by entity type)

Number of classifications possible per system- day (by entity type

Attrition Rate
System Acquisition and Operating Costs

Typical Parametric Trade-offs
Systems Effectiveness Parameters

Communication Nodes

- Node Capacity (for multiple activities)
- Segment Capacity
- Amount of time for information to travel across a node under ideal c
- Amount of time for information to travel over a segment under ideal
- Level of operation of nodes by category
- Level of operation of segments by category (i.e. VHF)
- Level of operation of individual nodes and segments
- Information routing options by target type
- Node or Segment Costs

Lift Systems

- Number of lift assets by type
- Weight capacity by lift type
- Volume capacity by lift type
- Refueling needs by lift type
- System Acquisition and Operating Costs

Tankers

- Refueling capabilities by type
- System Acquisition and Operating Costs

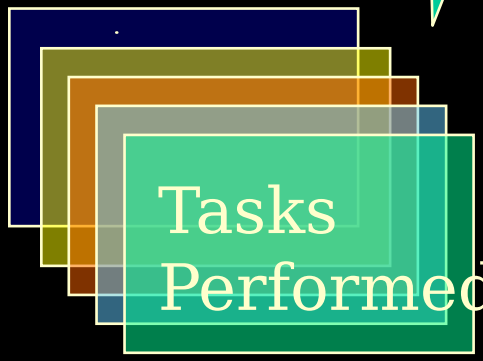
The Basic Concept

Operational Planner Perspective

TASKS & PRIORITIES

Destroy
Disrupt
Deny
Delay
Deploy
etc.

Resource Allocation (Math Program)



Tasks Performed

Resources Required

Typical Parametric Trade-offs
Scenario and Art of War Parameters

Concept of Operations

Different tasks and/or priority of each task (represents different Concepts of Operation)

Minimum acceptable levels of task(s) performed (e.g. . Minimum number of CC targets destroyed during 1st time period)

Maximum acceptable losses (Maximum levels of attrition etc.)

Theater/Scenario

Number of targets of each type in each distance band

Percent of targets which have significant value (estimate # of decoys and non- operational targets)

Number of systems (weapon, ISR, lift, communication etc.) in home inventory

Number of systems based in theater vs. in the CONUS

Size of theater and/or principle areas of interest

Expected weather patterns and terrain types

Command and Control Architecture

Budgetary

Acquisition Budget

Operational Budget

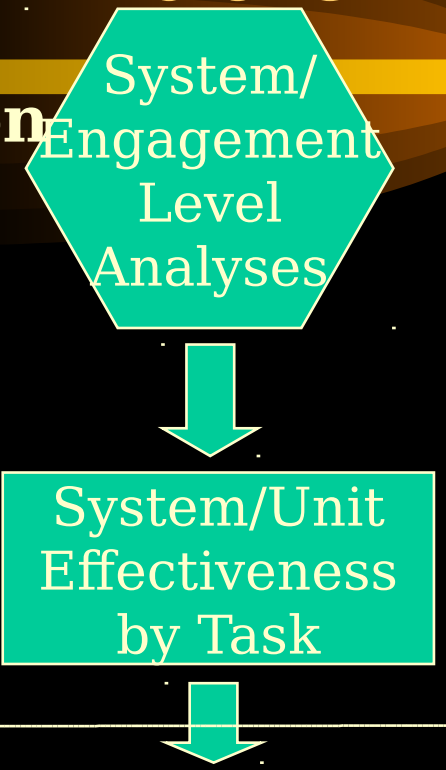
Individual System (Weapon, Munitions, ISR, Lift, etc.) Acquisition Cost

Individual System/Unit Operational Cost (by location)

Information

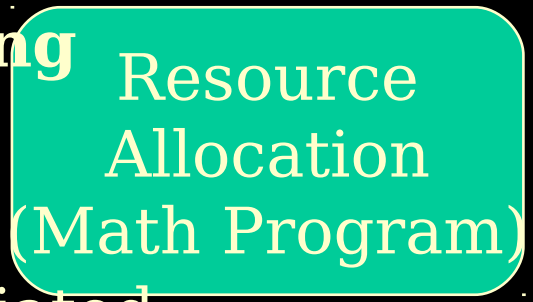
Information During Execution

Information content and timing
after
the task has been initiated impacts
system/unit effectiveness

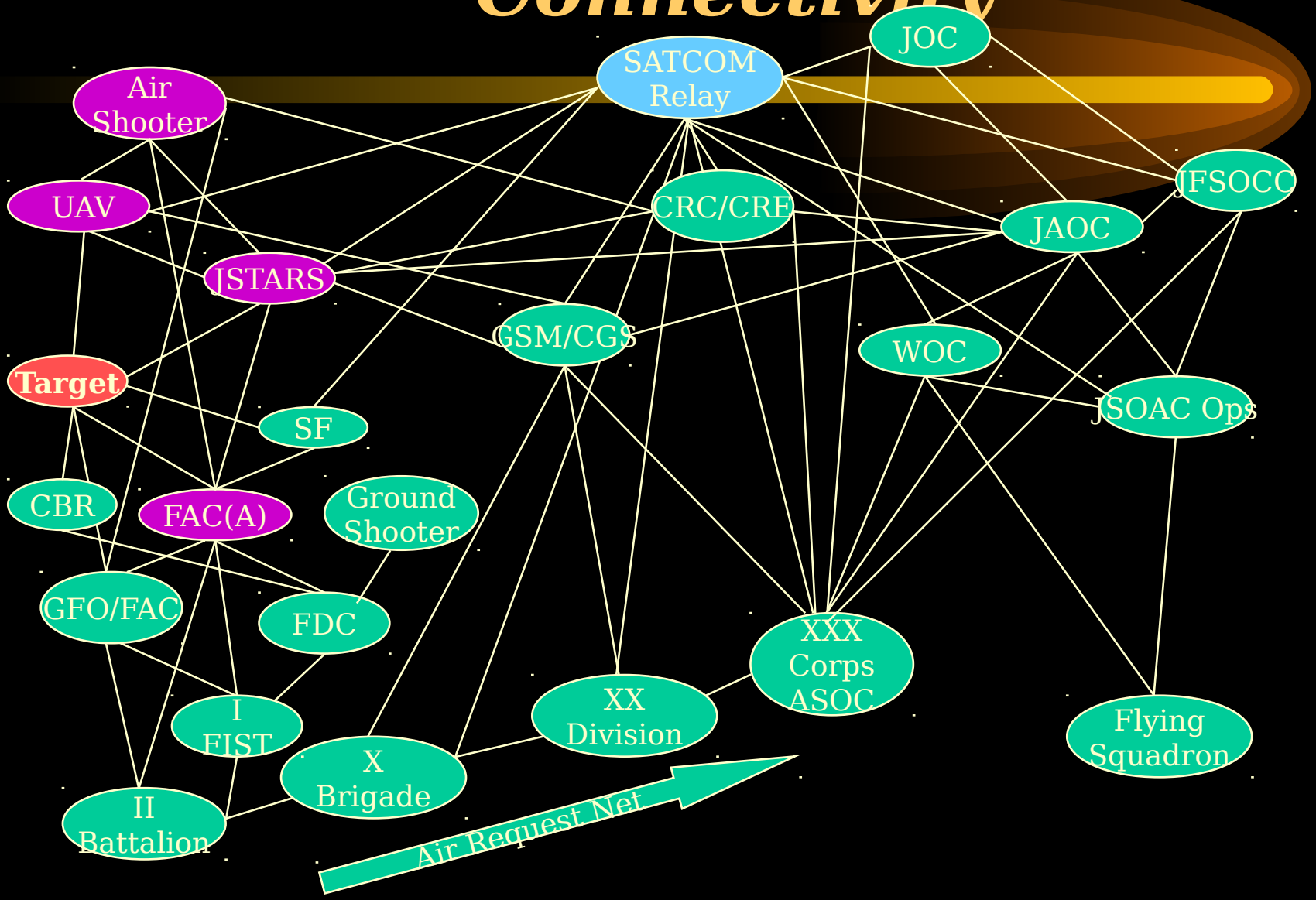


Information During Planning

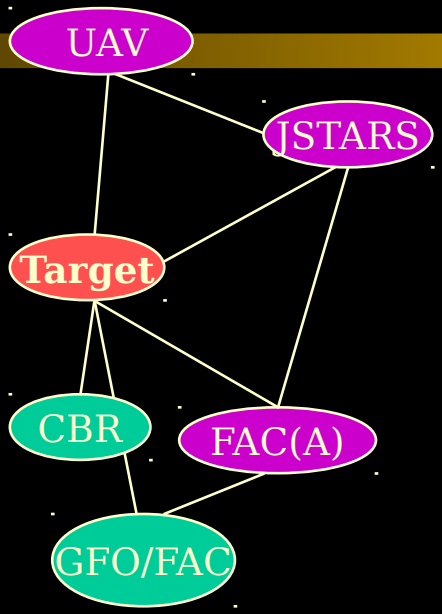
Information content and timing
during
nning determines if a task can be initiated



Node Connectivity



ISR Assets

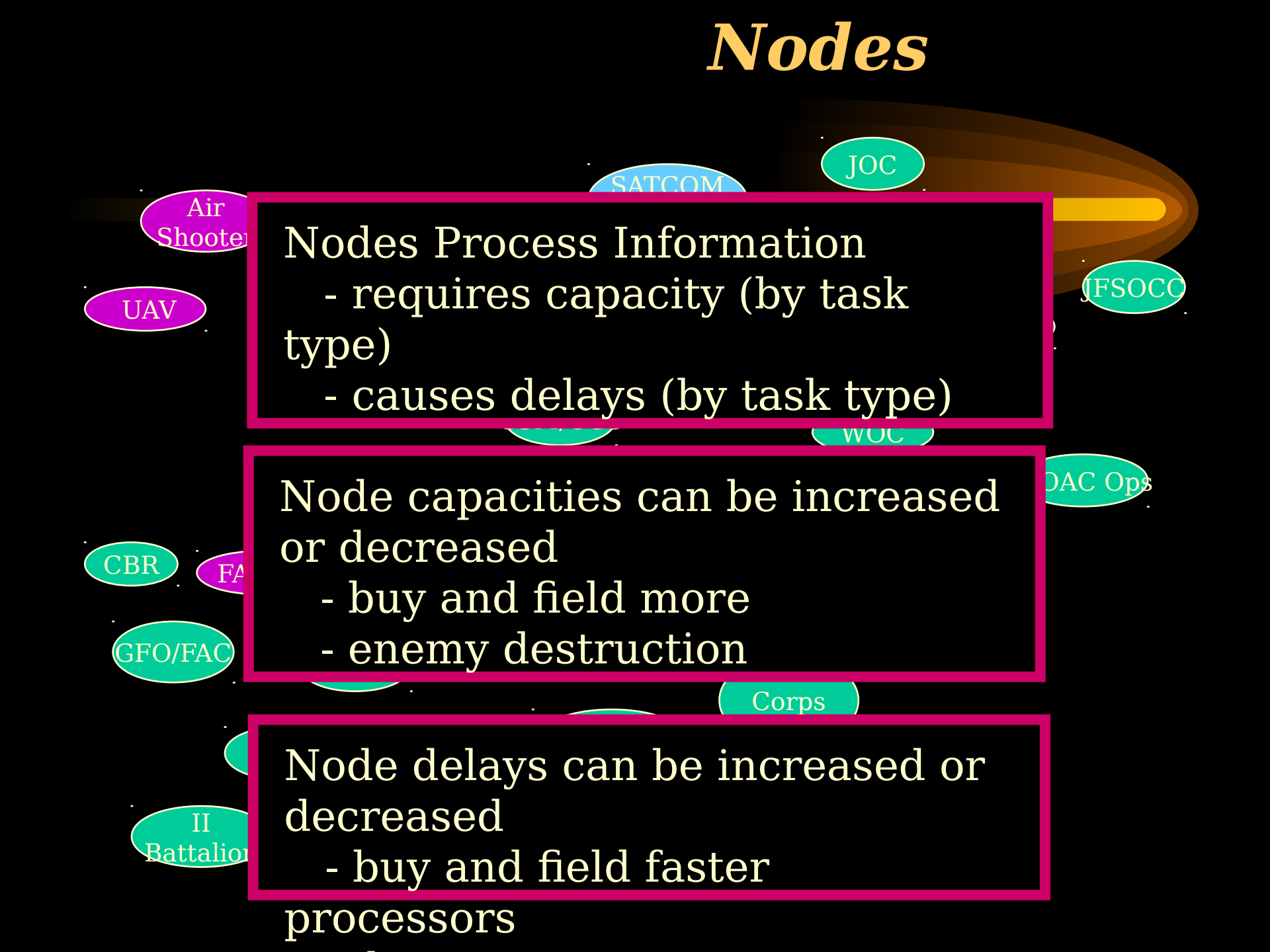


Detect/Gather/Collect - finding something and store raw data on it

Classify - identifying what that something is (e.g. a tank, enemy ord

Discriminate - figuring out if the thing is a real (valuable) entity (i.
operational systems that is not damaged and is not a decoy)

Nodes



Nodes Process Information
- requires capacity (by task type)
- causes delays (by task type)

Node capacities can be increased or decreased
- buy and field more
- enemy destruction

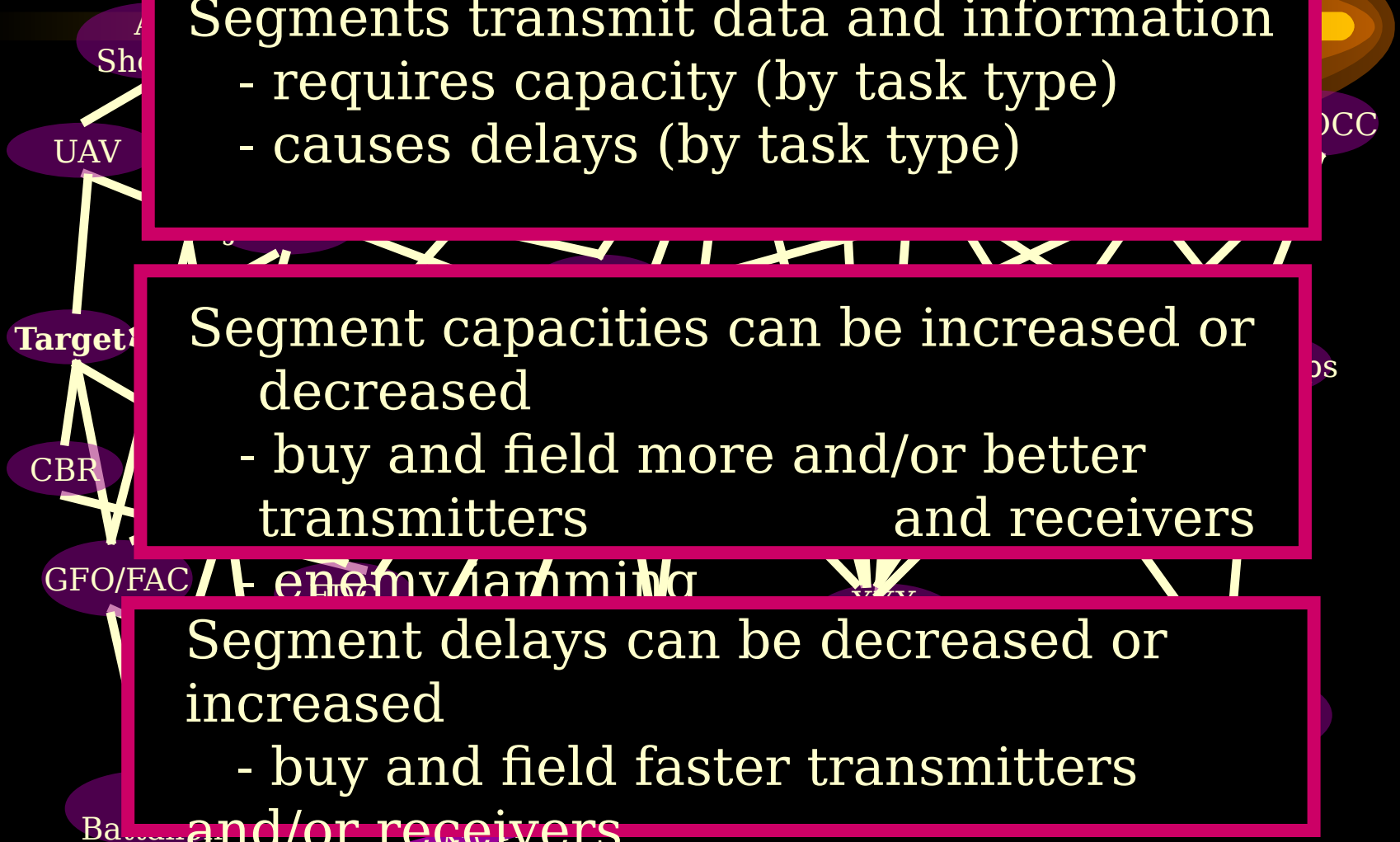
Node delays can be increased or decreased
- buy and field faster processors

Comm Segments or Links

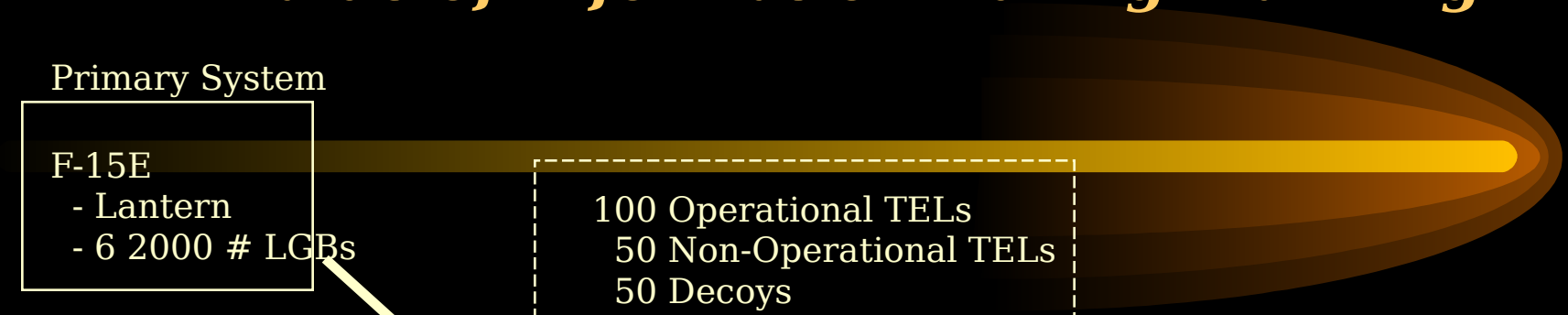
Segments transmit data and information
- requires capacity (by task type)
- causes delays (by task type)

Segment capacities can be increased or decreased
- buy and field more and/or better transmitters and receivers
- enemy jamming

Segment delays can be decreased or increased
- buy and field faster transmitters and/or receivers
- decrease in transmitter and/or receiver efficiency



Value of Information During Planning



Primary System

F-15E
- Lantern
- 6 2000 # LGBs

100 Operational TELs
50 Non-Operational TELs
50 Decoys

Task - 2.3.4

Destroy 80 Operational TBM TELs in 5 days

Tactics ttt
Assume 2 Sorties per day
Ignore Attrition
TEL is worth 100 points
P(engaging/sortie) = .2
P(d) = .8 per engagement

Engagement Level Analysis - Output

1000 F-15 E Sorties

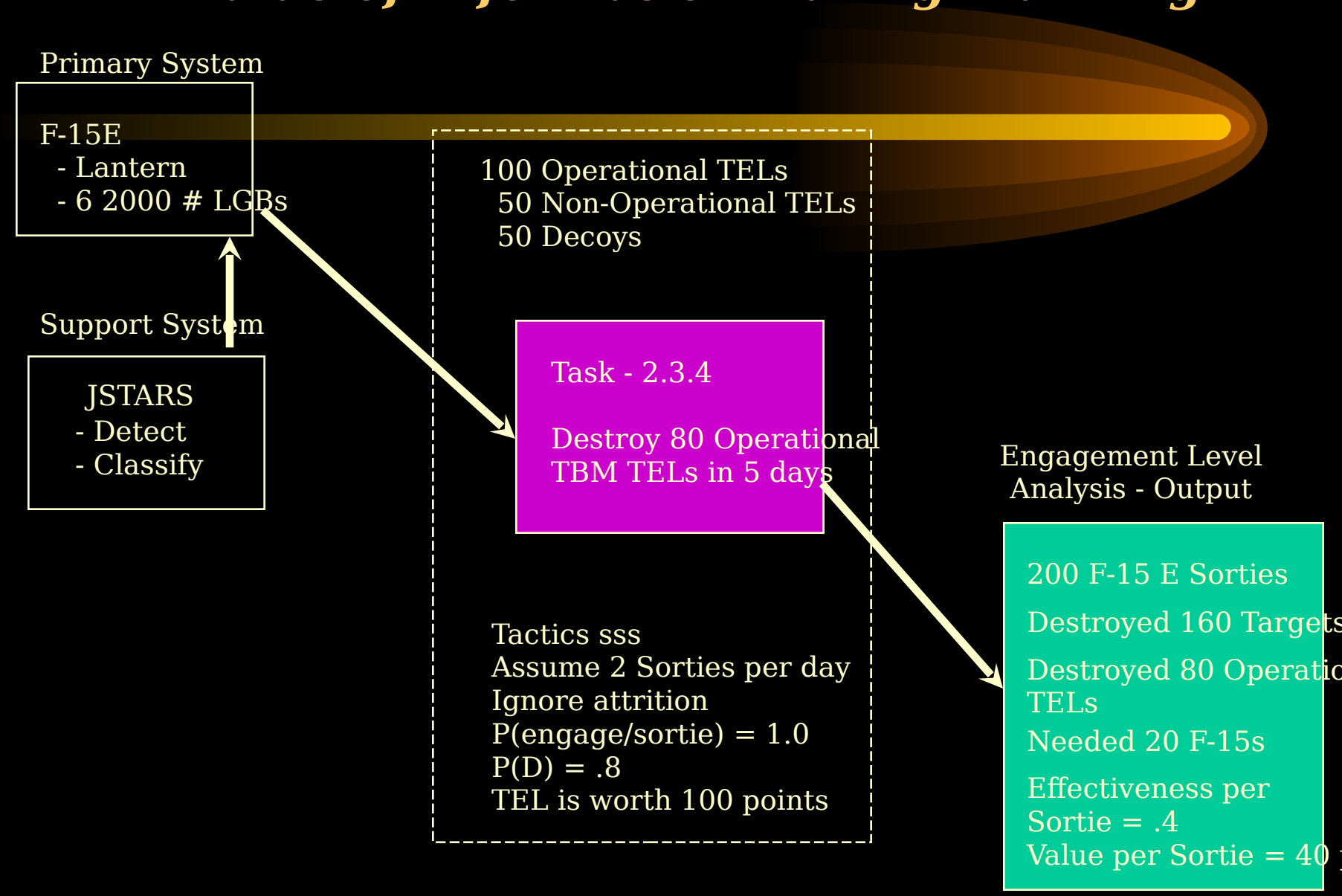
Destroyed 160 Targets

Destroyed 80 Operatio
TELs

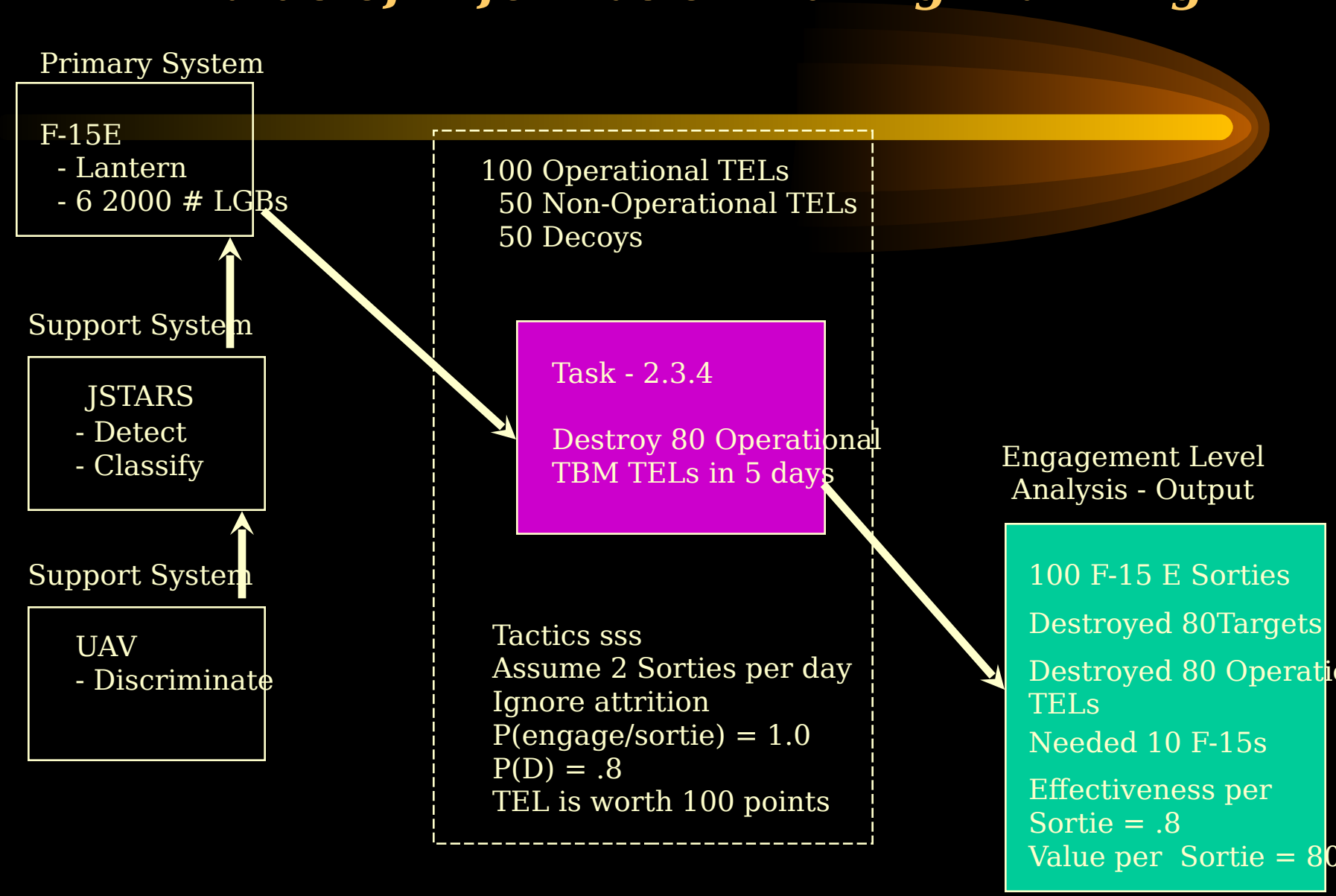
Needed 100 F-15s

Effectiveness per Sortie = .08
Value per Sortie = 8 p

Value of Information During Planning



Value of Information During Planning



Ongoing Activities

Complete by end of 1998

- CID Study feasibility demonstration
  - developing a notional database
  - demonstrating application
- ID data sources
- Improve data entry methods
- ID hardware & software constraints

"Technical" Priorities

- Work with a CINC's planning staff to establish a baseline set of TASKS and time requirements
- Work with the ISR community to ensure we have developed the right approach for allocating ISR assets
- Establish a baseline Communication Architecture and database
- Run large problems on high end PCs and UNIX systems

Future Activities

- Data Gathering/Updating 40%
- Data Management 25%
- Model Validation and Verification 10%
- User Interface Improvements 15%
- Model Enhancements 10%
- Beta tests
  - J-8
  - CINC